Ion acoustic wave collapse via two-ion wave decay: 2D Vlasov simulation and theory\textsuperscript{1} THOMAS CHAPMAN, RICHARD BERGER, Lawrence Livermore National Laboratory, JEFFREY BANKS, Rensselaer Polytechnic Institute, STEPHAN BRUNNER, Ecole Polytechnique Federale de Lausanne — The decay of ion acoustic waves (IAWs) via two-ion wave decay may transfer energy from the electric field of the IAWs to the particles, resulting in a significant heating of resonant particles. This process has previously been shown in numerical simulations to decrease the plasma reflectivity due to stimulated Brillouin scattering. Two-ion wave decay is a fundamental property of ion acoustic waves that occurs over most if not all of the parameter space of relevance to inertial confinement fusion experiments, and can lead to a sudden collapse of IAWs. The treatment of all species kinetically, and in particular the electrons, is required to describe the decay process correctly. We present fully kinetic 2D+2V Vlasov simulations of IAWs undergoing decay to a highly nonlinear turbulent state using the code LOKI. The scaling of the decay rate with characteristic plasma parameters and wave amplitude is shown. A new theory describing two-ion wave decay in 2D, that incorporates key kinetic properties of the electrons, is presented and used to explain quantitatively for the first time the observed decay of IAWs.

\textsuperscript{1}Work performed under auspices of U.S. DoE by LLNL, Contract DE-AC52-07NA2734. Funded by LDRD 15-ERD-038 and supported by LLNL Grand Challenge allocation.

Thomas Chapman
Lawrence Livermore National Laboratory

Date submitted: 22 Jul 2015

Electronic form version 1.4